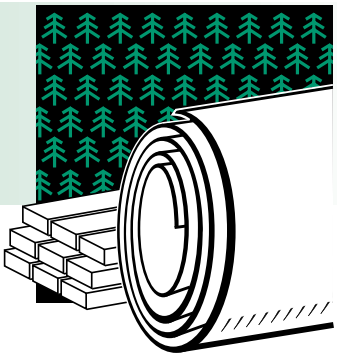
FOREST PRODUCTS

Project Fact Sheet



Increasing Yield and Quality of Low-Temperature, Low-Alkali Kraft Cooks with Microwave Pretreatment

Benefits

- Improves yield and throughput of existing kraft mills
- Requires less energy per weight of pulp
- Uses fewer pulping and bleaching chemicals
- Eliminates “bottlenecks” in lime kiln and recovery boiler
- Reduces wood losses from debarking and shives
- Encourages use of coppice and other young wood forms
- Lowers processing time and costs

Applications

Microwave pretreatment technology will be applicable to kraft, soda, sulfite, and other chemical pulping processes. It is estimated the market for this retrofit technology will be up to 75 percent of chemical pulping mills.

New Process Will Minimize the Variations in Fiber Sources Prior to Pulping

Since drying is the most energy intensive step in pulp processing, it contributes a significant cost to the industry. Microwave/radio-frequency (RF) drying is a promising alternative to current higher-temperature drying methods. Preliminary work on pretreated logs and dimensional lumber has shown that rapid, controlled application of microwave/RF energy to sections of whole wood increases pulp yield and reduces cooking chemicals and energy use in conventional kraft pulping.

In a follow on project, Investigators will carry out systematic studies on wood chips to determine how variations in different microwave parameters affect the quality and yield of wood pulp produced using low-temperature or low-cooking-chemical digestion regimes. The ultimate project goal is a proof-of-concept demonstration of a powerful microwave/RF pretreatment process. Some effort will be devoted to improving the pulping of difficult furnishes.

Successful demonstration of a microwave/RF pretreatment process is expected to increase the yield of kraft pulp by 3 to 12%, decrease the amount of chemicals used for cooking by about 20%, reduce energy use for cooking pulp and for the lime kiln, increase Tomlinson boiler throughput, and decrease the Kappa number of conventionally pulped wood by up to 20%. This technology may also decrease wood lost to debarking and shives; it is likely to be cost-competitive with anthraquinone for pulping processes.

Microwave Drying of Wood

Figure 1. The broken bordered pits of pretreated pine. Microwaves generate steam pressure inside the wood, which breaks pit membranes and vessel cell walls, thereby enhancing the wood’s permeability to chemicals and process liquors.

Project Description

Goals: To develop a proof-of-concept demonstration of a microwave/RF pretreatment process that improves productivity and cost-competitiveness in conventional kraft pulping mills.

Researchers will conduct a three-year project to: 1) develop a qualitative understanding of the effect of microwave/RF pretreatment on digester operating conditions, 2) develop data for designing microwave/RFsystems for treating both logs and chips in full-scale plants, 3) develop data on process energy and mass along with preconceptual and conceptual designs that show how the proposed process would fit in a kraft mill, and 4) evaluate the quality of pulp from pretreated wood in terms of yield, kappa number, brightness, handsheet properties, shives, and freeness. Some time will be given throughout the period to using the technology to improve the pulping of difficult-to-use furnishes, providing an opportunity for a commercial-scale test.

Progress & Milestones

- A previous Agenda 2020 research project on lumber, cants, and logs demonstrated higher yield, lower kappa number, less chemicals, and a faster rate of downstream wood drying with no effect on mechanical properties. This box and conveyer system is currently being patented.

- Research on sycamore wood chips indicated there is a strong possibility of increasing yields and decreasing kappa by microwave-preheating logs, chipping them, and immersing the chips directly in pulping liquor.

- Investigators will evaluate longer sycamore chips and loblolly pine (a softwood commonly part of the furnish of many mills) for future microwave trials.

Project Partners

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GL&V/Impco-Jones, Inc.
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February 2001